



# Argonne National Laboratory Overview



Office of Technology Transfer



Argonne National Laboratory

<http://www.anl.gov>

# About Argonne



*Pioneering Science and Technology*

- **Founded in 1943, designated a national laboratory in 1946**
- **Managed by The University of Chicago for the Department of Energy**
  - ~4000 employees and 4000 facility users
  - ~\$500M budget
  - 1500-acre site in Illinois
  - 800-acre site in Idaho
- **Broad R&D portfolio**
- **Numerous sponsors**



# Argonne's Mission



*Pioneering Science and Technology*

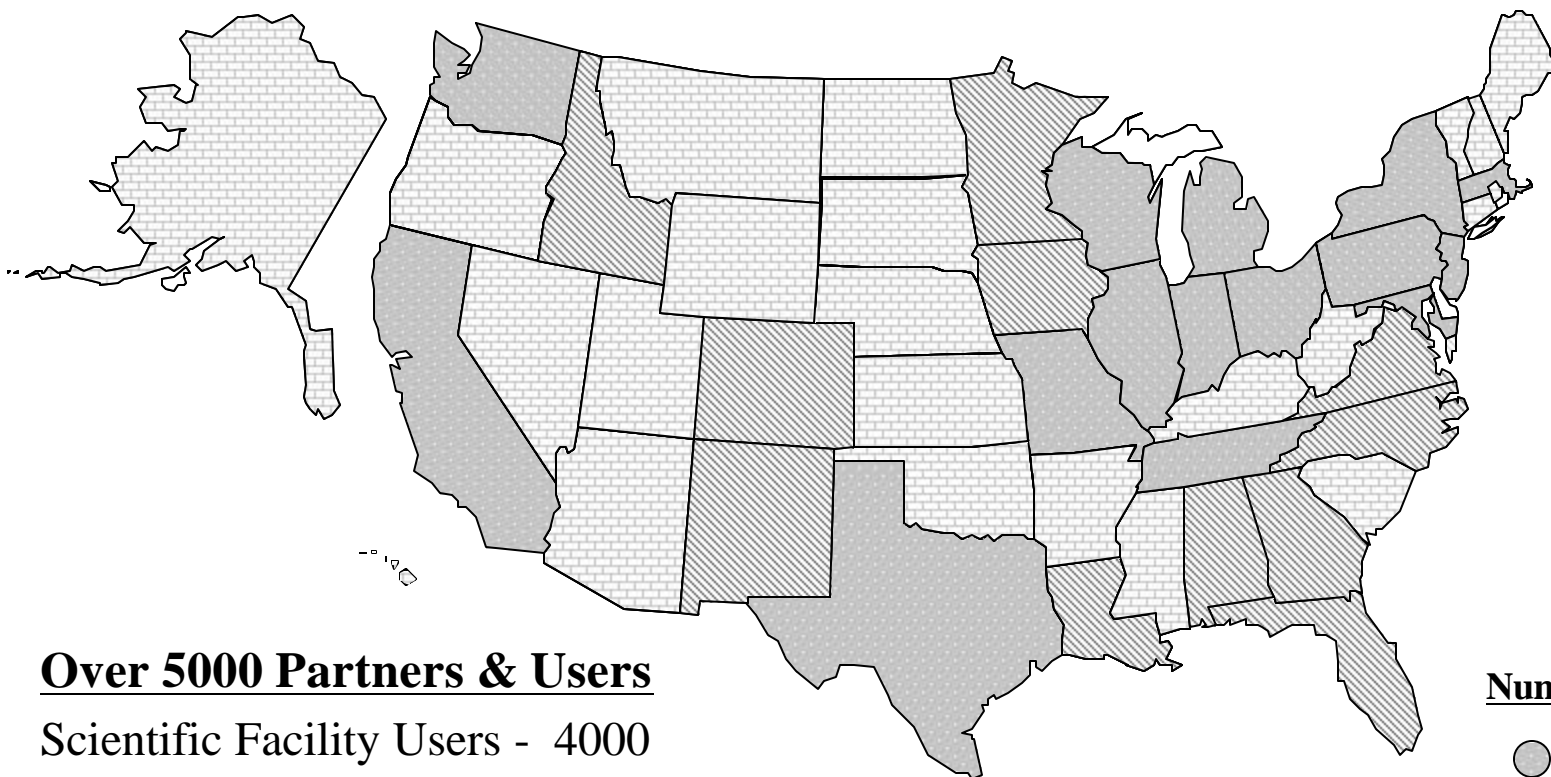
- **Serve DOE & national security**
  - Advancing the frontiers of knowledge
  - Creating and operating forefront scientific user facilities
  - Providing innovative and effective tools and solutions for energy and environmental challenges to national and global well-being, in the near and long term
- **In accomplishing its mission, Argonne partners with DOE, other federal labs, academia, and the private sector**



# Partnerships with National Impact



*Pioneering Science and Technology*



## Over 5000 Partners & Users

Scientific Facility Users - 4000

Industrial R&D partnerships - 850

Research Students - 550

Others - 200

## Number of Users

- 100 & over
- ▨ 31 – 100
- ▩ 1 - 30



# Forefront Science and Engineering



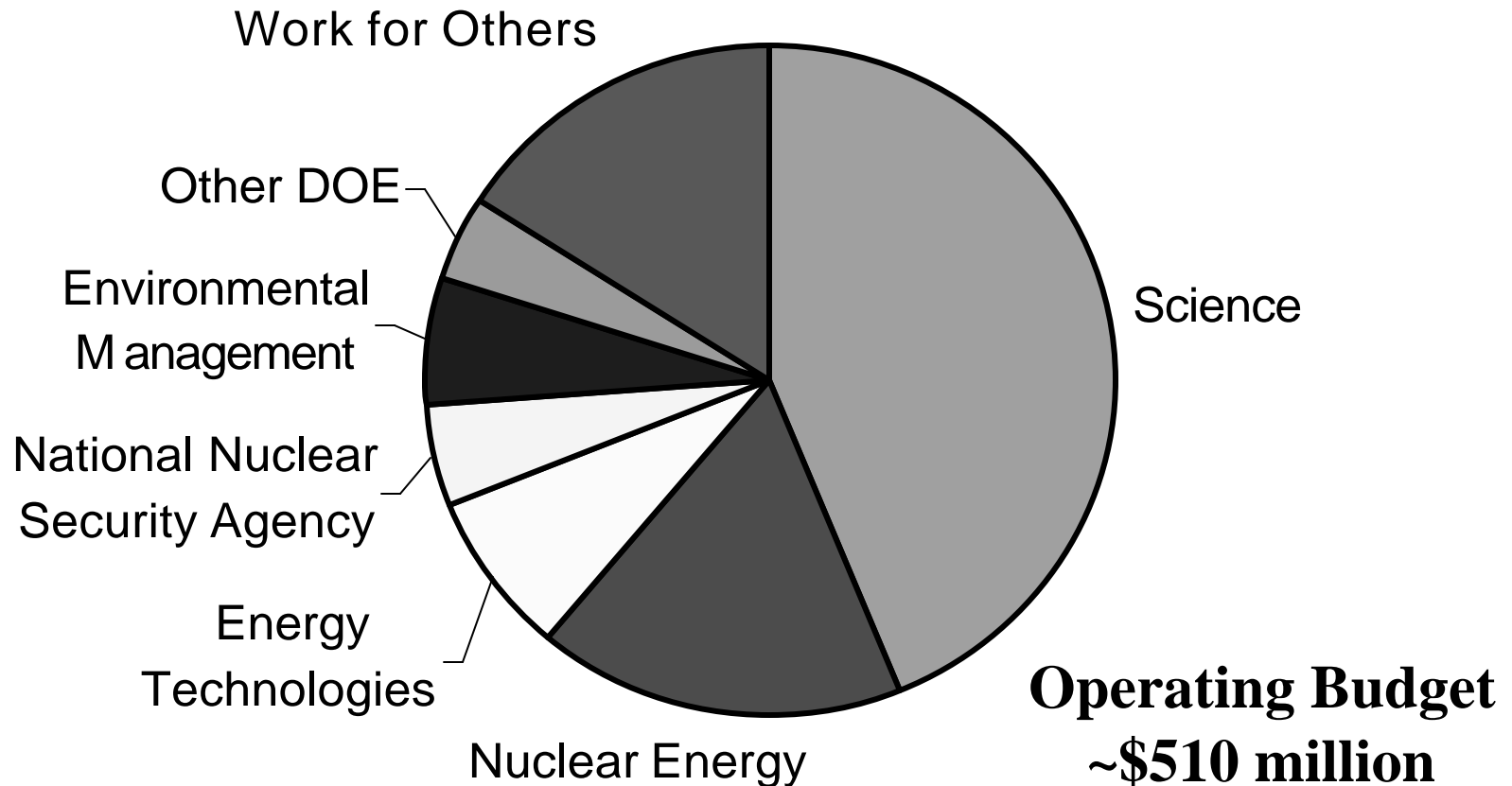
*Pioneering Science and Technology*

- **Basic and applied research**
  - Materials and chemical sciences and engineering
  - High-energy, nuclear, and atomic physics
  - Multidisciplinary nanoscience and nanotechnology
  - Structural biology, functional genomics, and bioinformatics
  - Energy & Environmental science, technology, and assessment
  - Transportation technology
  - Computer science and applied mathematics
  - Computational science
- **Design, construction, and operation of accelerator-based user facilities**
- **Design, development, and evaluation of advanced nuclear energy systems and proliferation-resistant nuclear fuel-cycle technologies**



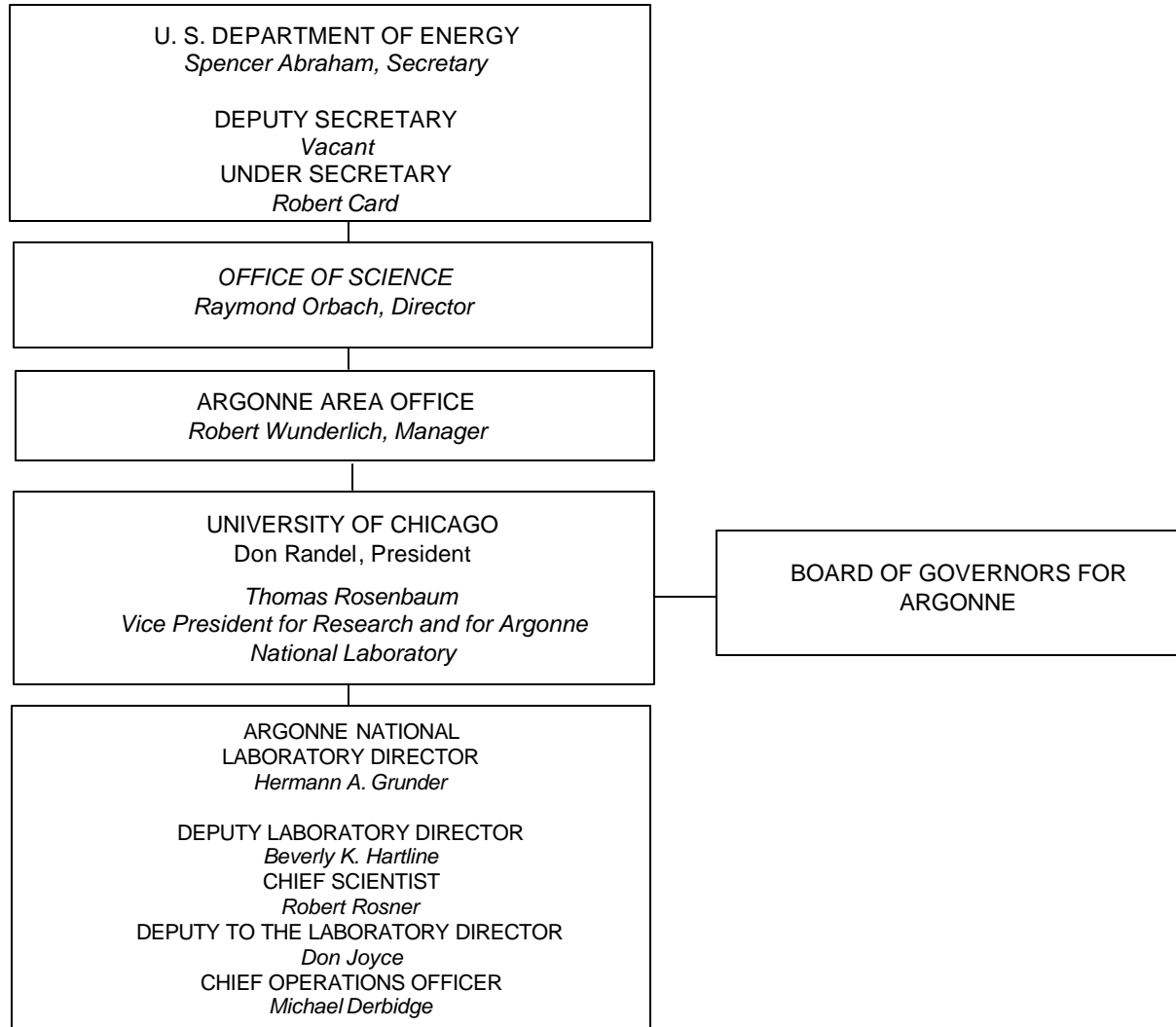
# Broad R&D Portfolio Serving National Needs

*Pioneering Science and Technology*



# Argonne is a DOE Science Laboratory

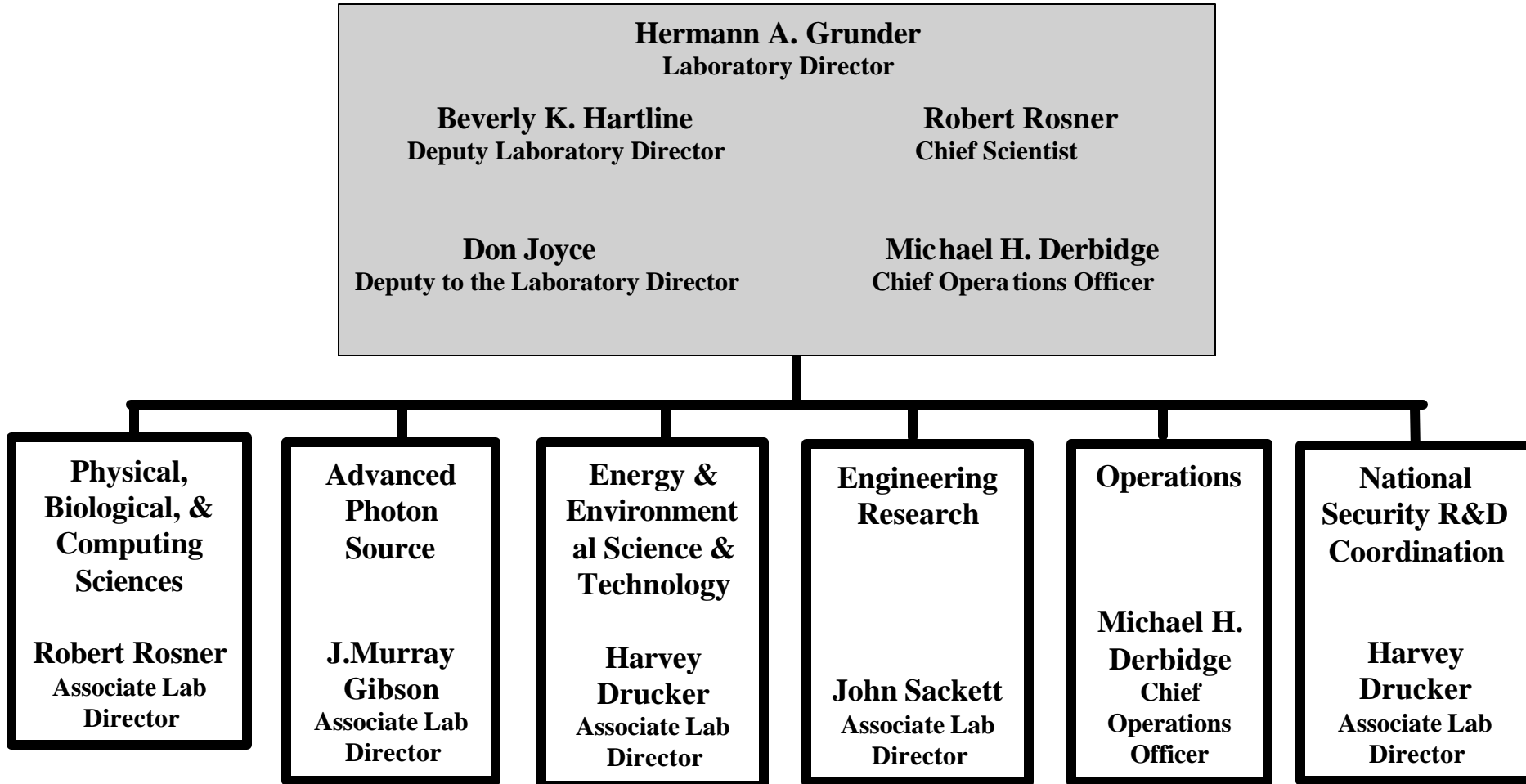
*Pioneering Science and Technology*



# Argonne Organization



*Pioneering Science and Technology*



- 22 Scientific/technical divisions
- 10 Operations/support organizations



# Partnership Opportunities



*Pioneering Science and Technology*

- **User facility access**
  - Advanced Photon Source (APS)
  - Intense Pulsed Neutron Source (IPNS)
  - Argonne Tandem Linac Accelerator System (ATLAS)
  - Many others
- **Participation in Argonne's Major initiatives**
- **Industrial R&D partnerships/agreements**
- **Topical workshops and 'summer schools'**
- **Science and engineering collaborations on other projects of mutual interest**
  - Faculty and student research
  - Educational outreach

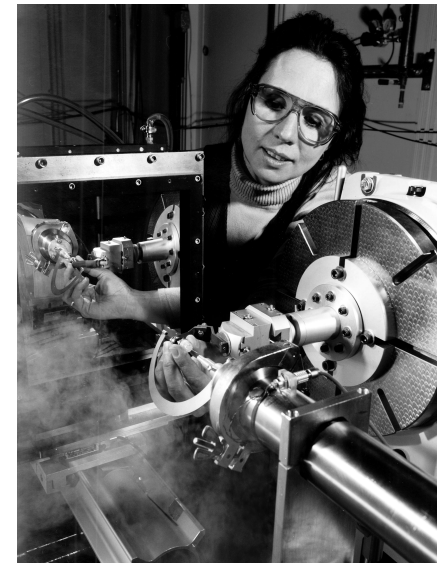


# Advanced Photon Source



*Pioneering Science and Technology*

- Nation's most brilliant hard x-ray beams
- Materials science, chemistry, biology, protein crystallography, earth & environmental science, physics...
- 42 beamlines in operation
- Over 3000 users
- Operates year-round, 5000 hours/year
- Reliability over 95%
- Innovative x-ray instrumentation and operating modes
- **Contact: Murray Gibson,**  
**[gibson@anl.gov](mailto:gibson@anl.gov), 630.252.7990**  
**<http://www.aps.anl.gov/>**

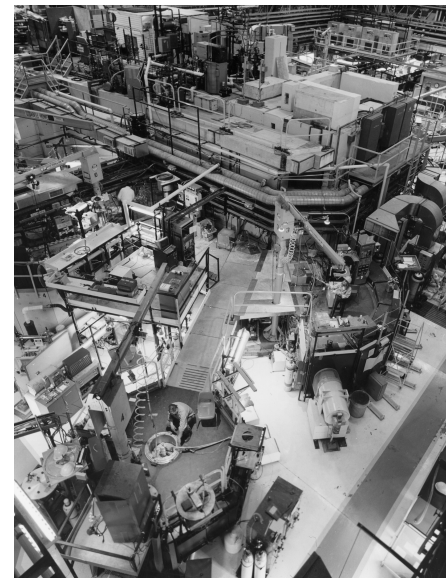


# Intense Pulsed Neutron Source (IPNS)



*Pioneering Science and Technology*

- Pulsed thermal and cold neutron beams
- Materials science, chemistry, biology, physics, geology, nuclear science, engineering sciences
- 13 instruments
- 240 users/visitors per year
- Reliability >95%
- Instrument and technique innovation
- Instrumentation and user-community development for Spallation Neutron Source (SNS) being built at Oak Ridge
- **Contact: Ray Teller, [rteller@anl.gov](mailto:rteller@anl.gov), 630.252.4999; <http://www.pns.anl.gov/>**

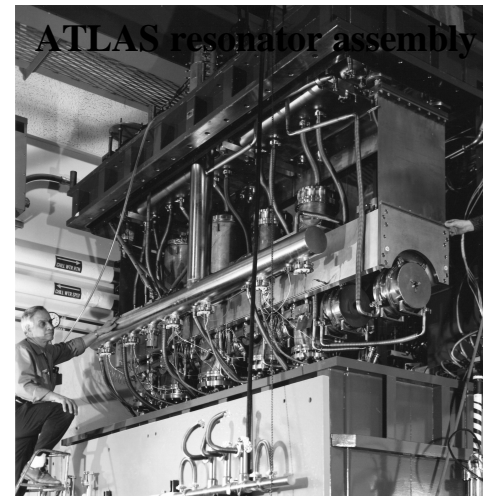


# Argonne Tandem Linac Accelerator System (ATLAS)



*Pioneering Science and Technology*

- Low-energy, precision beams of any ion from protons to uranium
- Nuclear physics
- 8 experiment areas
- Over 350 active users
- >95% reliability
- Scientific and technical base for Rare Isotope Accelerator
- Low-beta superconducting accelerator technology
- **Contact: Jerry Nolen: [nolen@anl.gov](mailto:nolen@anl.gov), 630.252.6418; <http://www.phy.anl.gov/atlas/>**

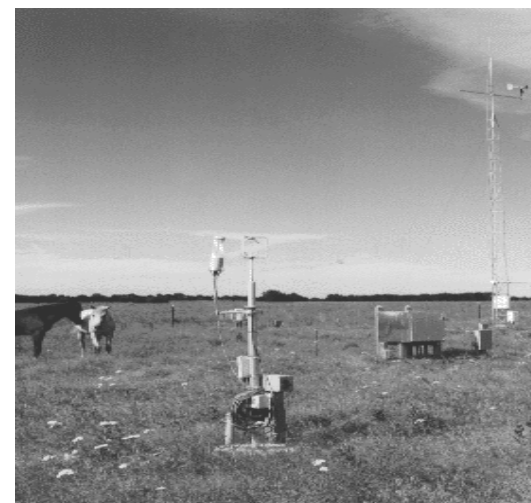


# Energy and Environmental Science and Technology



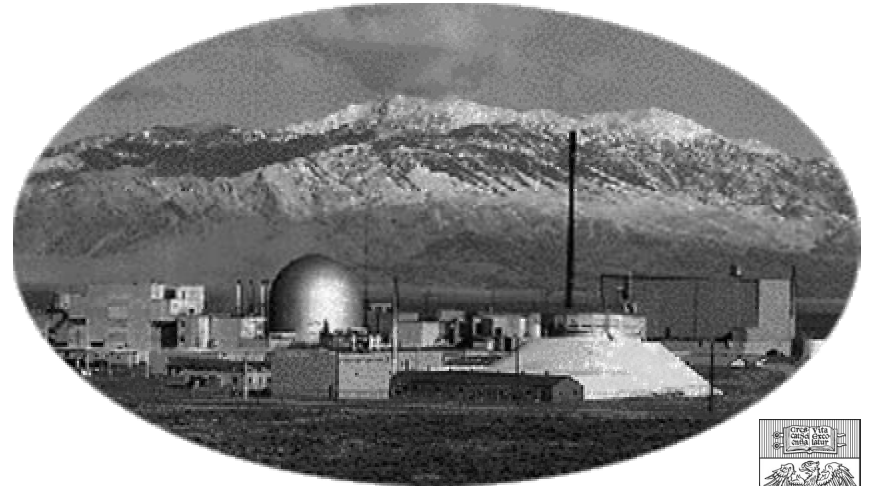
*Pioneering Science and Technology*

- Energy systems and technologies
- Environmental assessment, research, technology, and restoration
- Transportation, industrial energy and efficiency
- Decision and Information Sciences
  - Infrastructure Assurance Center



# Engineering Research

- **Advanced nuclear technology**
- **Chemical engineering and electrometallurgical technology**
- **Radioactive and mixed waste treatment technology**
- **Nuclear nonproliferation**
- **Nuclear facility decontamination and decommissioning**
- **A world leader in nuclear reactor and fuel cycle research.**



# Future Workforce Development & Educational Outreach



*Pioneering Science and Technology*

Challenge: Enrich science education and help prepare tomorrow's scientists and engineers

Approach:

- Research opportunities for undergraduates
- Research partnerships between faculty and Argonne
- Support of K-12 science education in the community

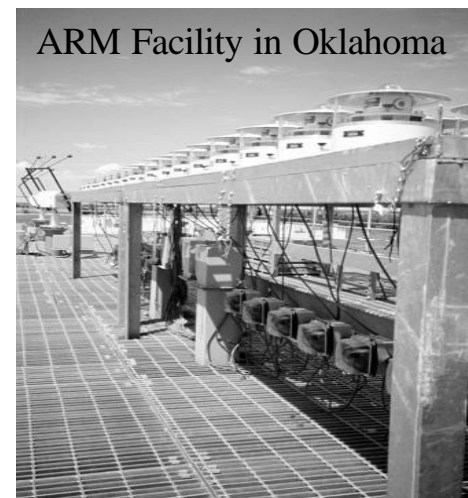


# Other Significant R&D Facilities



*Pioneering Science and Technology*

- Electron Microscopy Center  
[www.msd.anl.gov/groups/emcmr/](http://www.msd.anl.gov/groups/emcmr/)
- Atmospheric Radiation Measurement (ARM) program [www.arm.gov](http://www.arm.gov)
- Transportation Technology R&D Center  
[www.transportation.anl.gov](http://www.transportation.anl.gov)
- DOD approved Dilute Chemistry Facility  
[www.es.anl.gov/htmls/RDTE.html](http://www.es.anl.gov/htmls/RDTE.html)
- Alpha-Gamma Hot Cell Facility  
[www.et.anl.gov/sections/ip/facilities/aghcf.html](http://www.et.anl.gov/sections/ip/facilities/aghcf.html)
- Argonne-West nuclear facilities in Idaho  
[www.anlw.anl.gov](http://www.anlw.anl.gov)
- Many more:  
[www.anl.gov/OPA/progs.htm#sf](http://www.anl.gov/OPA/progs.htm#sf)



# Argonne's Major Initiatives



*Pioneering Science and Technology*

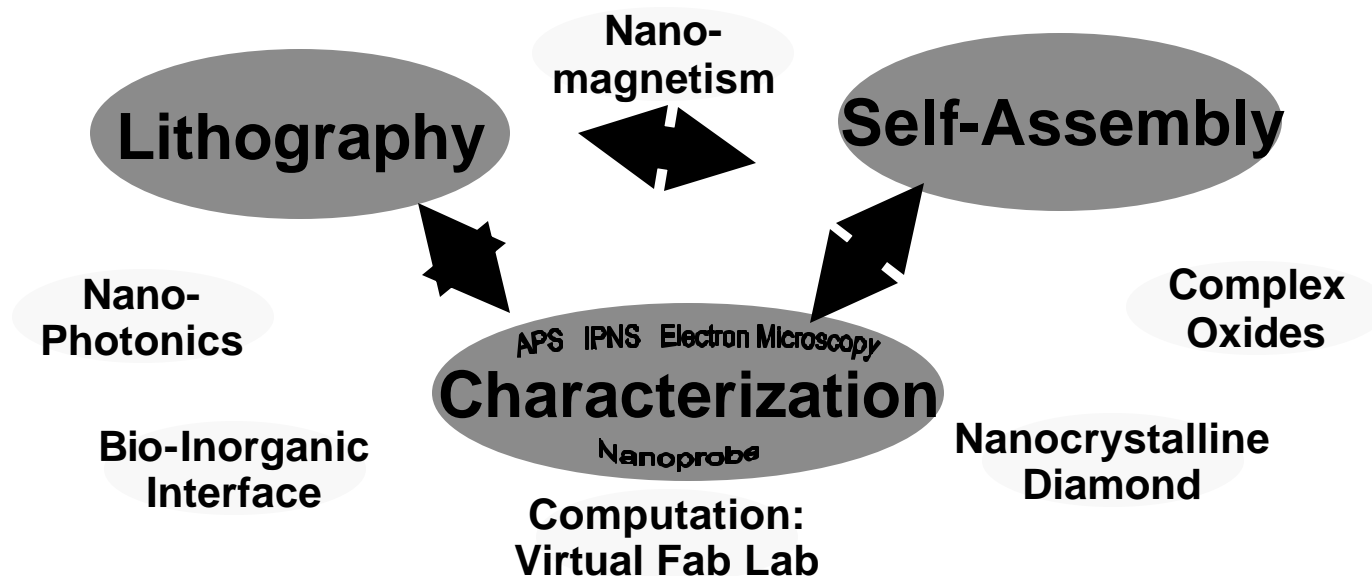
- **Nanoscience and nanotechnology: Center for Nanoscale Materials**
- **Petascale computers and computational science**
- **Rare Isotope Accelerator**
- **Bioscience: functional genomics**
- **Advanced nuclear fuel cycle**
- **Homeland security**



# Center for Nanoscale Materials



*Pioneering Science and Technology*



- One of DOE's five new Nanoscale Science Research Centers
- Forefront, interdisciplinary scientific themes
- State-of-the-art facilities and instrumentation; exploiting Advanced Photon Source and Intense Pulsed Neutron Source
- **For information: Sam Bader: [bader@anl.gov](mailto:bader@anl.gov), 630.252.4960; <http://nano.anl.gov/>**



# Advanced Computing



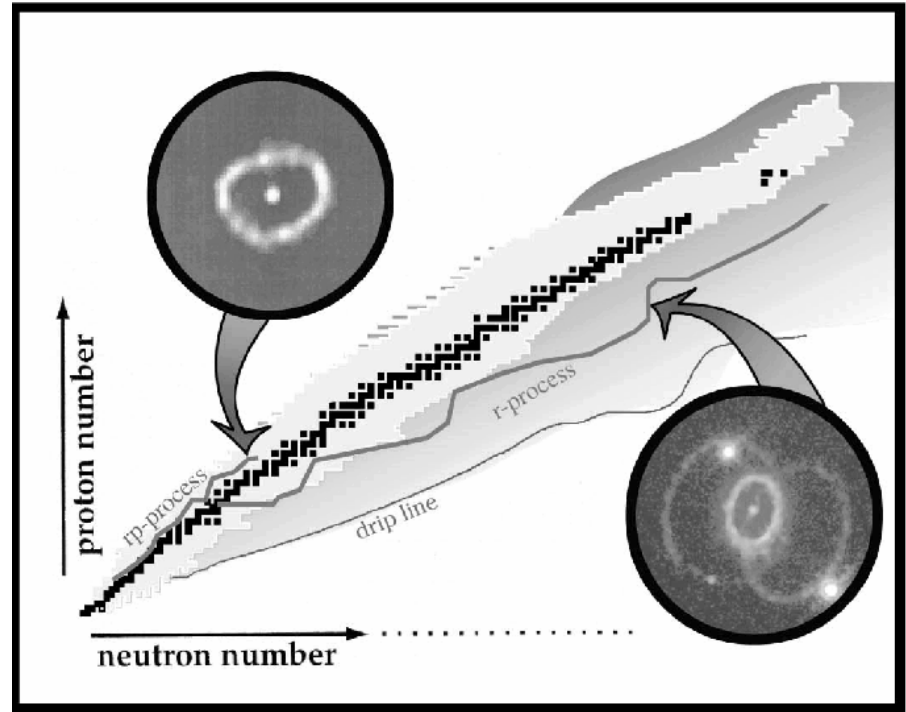
*Pioneering Science and Technology*

- **Strong ongoing programs with national impact**
  - Grid Computing: Globus, GridFTP
  - Scalable numerical tools: PETSc
  - Parallel computing: MPI, MPICH, Jumpshot
  - Advanced visualization:  $\mu$ Mural, AccessGrid
- **Advanced Computing Initiative**
  - Data-intensive science/advanced Grid technologies
    - Bioinformatics, APS CATs, RIA/LHC, ...
  - Complex systems science
    - Whole-cell modeling
    - Virtual Fab Lab/nanoscience: self-assembly
  - Petaflop computing
    - TeraGrid update & TeraGrid facility (NSF)/DOE Computing Initiative
    - Maintaining momentum, and responding to the Japanese challenge
- **For information: Rick Stevens, [stevens@mcs.anl.gov](mailto:stevens@mcs.anl.gov), 630.252.3378; <http://www.mcs.anl.gov/>**



# Rare Isotope Accelerator (RIA)

- **Proposed new ~\$1 billion research facility is highest priority new construction for nuclear physics**
  - Beams from protons to uranium
- **Exciting science**
  - The nature of nucleonic matter
  - The origin of elements
  - Energy generation in stars
  - Tests of symmetries and fundamental conservation laws
- **Important applications**
  - Stockpile stewardship
  - Radioactive ion implantation
  - Medical isotope R&D
- **National RIA team is forming around MSU and Argonne**
- **For information: Don Geesaman: [geesaman@anl.gov](mailto:geesaman@anl.gov), 630.252.4004; <http://www.phy.anl.gov/ria/>**



- **Major science foci:** structural biology, functional genomics, bioinformatics
- **Major facilities:**
  - Structural Biology Center at APS *Structure determination*
  - Midwest Center for Structural Genomics *High-throughput analyses*
  - APS, IPNS, ... *Neutrons and x-rays*
- **Technical capabilities**
  - Computing *Simulations and modeling*
  - Nanotechnology *Self-assembly, ...*
  - Robotics *High-throughput*
- **New directions:** bioinformatics and functional genomics
- **For information:** Lee Makowski: [lmakowski@anl.gov](mailto:lmakowski@anl.gov), 630.252.3819;  
<http://www.bio.anl.gov/>



# Advanced Nuclear Fuel Cycle



*Pioneering Science and Technology*

- **Demonstrate closed nuclear fuel cycle that consumes potential weapons material and simplifies nuclear waste storage requirements**
  - Reprocess spent nuclear fuel on a pilot-plant scale to extract remaining 98% of available energy
  - Separate short-lived fission products from spent fuel for geological repository
  - Recycle U, Pu, and minor actinides and consume in reactor fuel
- **Address key concerns of the public**
  - Ensure that the disposition and management of spent fuel and nuclear waste is safe and environmentally acceptable
  - Keep nuclear materials from diversion to weapons or terrorist use
- **Provide energy that is safe, greenhouse-gas-free, and economically competitive**
- **International partnership involving governments, industry, labs, and universities is forming now**
- **For information: John Sackett: [john.sackett@anl.gov](mailto:john.sackett@anl.gov), 630.252.4856; <http://www.era.anl.gov/>**

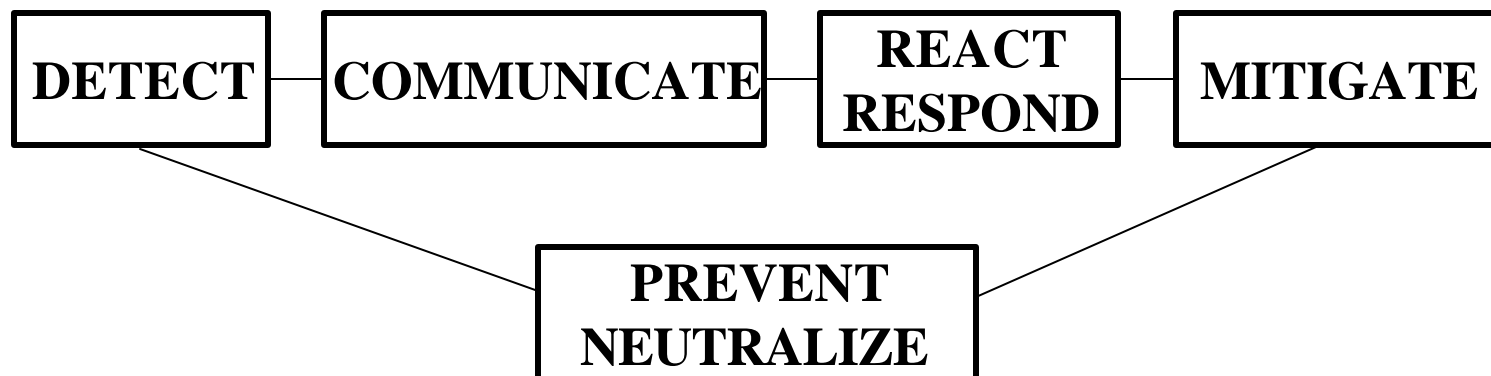


# Argonne's Homeland Security Resources



*Pioneering Science and Technology*

- **Expertise, knowledge, technologies, and specialized research facilities developed over decades for other purposes**
  - Nuclear
  - Chemical and biological
  - Systems-level risk analyses
  - Emergency preparedness and response



- **For information: Harvey Drucker: [drucker@anl.gov](mailto:drucker@anl.gov), 630.252.3804**



# Partnerships with Industry



*Pioneering Science and Technology*

- **Cooperative R&D agreements**
- **R&D contracts utilizing unique ANL skills and technology**
- **Technical service agreements to access unique facilities**
- **Technology license for commercial use**
- **Consortia membership, e.g.**
  - Advanced Transportation Technology Consortia
  - National Security Technology Partnerships
  - Central States Universities Consortium
- **Innovative start-ups & new ventures**
- **For information: Steve Ban: [sdban@anl.gov](mailto:sdban@anl.gov), 630.252.8111; <http://www.techtransfer.anl.gov/>**



# Cost-Shared R&D Under a CRADA



*Pioneering Science and Technology*

## **Under a Cooperative Research and Development Agreement (CRADA):**

- **Federal laboratory(ies) and nonfederal/industrial partner(s)**
- **Parties generally share R&D costs**
  - Lab work may be funded by government (DOE, other agencies) or partner
  - No funds from lab to CRADA partner
- **Company has the right to retain ownership of intellectual property it develops under the CRADA**



# Cost-Shared R&D Under a CRADA (continued)

*Pioneering Science and Technology*



- **Laboratory has the right to retain ownership of intellectual property it develops under the CRADA**
- **Company may obtain (by negotiation with the laboratory) rights to intellectual property developed by the laboratory**
- **Data may be withheld from public disclosure for up to five years**



# Reimbursable R&D (Work for Others)



*Pioneering Science and Technology*

**Under reimbursable research and development (Work for Others, WFO) agreements:**

- **Work is performed by Argonne**
- **Generally, full costs paid by industrial partner**
- **Under certain circumstances, company may obtain title to intellectual property created under WFO**
- **Research results may be kept proprietary and are not subject to public disclosure**



# Licensing



*Pioneering Science and Technology*

- **Supports cooperative agreements**
- **Background inventions available**
- **Options are available**



# Technical Assistance

---

**Argonne helps companies with short-term technical problems in areas of expertise not available commercially**

- **Reimbursable Technical Services Agreement**
  - May not involve research
  - Not limited in scope or cost
  - Company or other organization pays full cost

# Research Facilities

---

- All Argonne facilities may be utilized via customary working arrangements
- “Designated user facilities” are intended for shared use by industry, universities
  - Large, one-of-a-kind research facilities
  - Use may be proprietary (fee charged) or nonproprietary (no fee charged: project must meet certain criteria, and results must be shared openly)

# **Working with Foreign Companies**

---

*Pioneering Science and Technology*

- **Possible relationships between Argonne and foreign companies:**
  - Cost-shared R&D
  - Fully reimbursable R&D or technical service
  - Nonexclusive licensing of patents and copyrights
  - Consultant arrangements and other technical collaborations
- **DOE establishes certain limitations that are reviewed on a case-by-case basis**

# Licensed Inventions on the Market or in Industrial Use



*Pioneering Science and Technology*

- **Chemical extractor**
- **Real-time laser weld monitor**
- **Partial Oxidation Reforming Catalyst**
- **Biological microchip ("biochip") analyzer and loader**
- ***Ceramicrete* phosphate-bonded ceramic**
- **Excimer laser for angioplasty**
- **Electron microscope plasma cleaner**
- **Leukemia antibodies (hybridomas)**
- **Nanophase materials**
- **Separation resins**
- **Superconducting powders/bearing levitators/sputtering targets/precursor materials/current lead connectors**



# Licensed Software on the Market or in Industrial Use

---



*Pioneering Science and Technology*

- **MSET (sensor calibration and monitoring)**
- **GCTool (fuel cell modeling)**
- **LDAP (Internet library browser)**
- **ADIntrinsics & SparsLinc (ADIFOR) (automatic differentiation of Fortran 77 programs)**
- **Casting Process Simulator (CaPS) (modeling casting processes)**
- **Experimental Physics & Industrial Control Systems (EPICS)**
- **General Geometry Transport, 2D (GTRAN2)**
- **Message Passing Interfaces Parallel Computing (MPICH) (implementation of the Message Passing Interface Standard)**

